Journals (*continued*).

Medico-Legal Journal. Vol. VI. No. 3. 8vo. *New York* 1888.
The Editor.

Naturalist (The). Nos. 165–166. 8vo. *London* 1889.
The Editors.

Revista do Observatorio. 1889. Num. 2–3. 8vo. *Rio de Janeiro.*
Imperial Observatory, Rio de Janeiro.

Revue Médico-Pharmaceutique. 1889. No. 2. 4to. *Constantinople.*
The Editor.

Stazioni Sperimentali Agrarie Italiane (Le). Vol. XV. Fasc. 3. Vol. XVI. Fasc. 1–3. 8vo. *Roma* 1888–89. The Editor.

Technology Quarterly. Vol. II. No. 3. 8vo. *Boston* 1889.
The Editors.

Zeitschrift für Naturwissenschaften. 1887. Hefte 3–6. 1888. Hefte 1–4. 8vo. *Halle.*
Naturwissenschaftlicher Verein, Halle.

"On the Limit of Solar and Stellar Light in the Ultra-violet Part of the Spectrum." By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S. Received March 28,—Read April 4, 1889.

It has been long known that the solar spectrum stops abruptly, but not quite suddenly, at the ultra-violet end, and much sooner than the spectra of many terrestrial sources of light. The observations of Cornu, of Hartley, and, quite recently, of Liveing and Dewar, appear to show that the definite absorption to which the very rapid extinction of the solar spectrum is due, has its seat in the earth's atmosphere, and not in that of the sun; and that, consequently, all ex-terrestrial light should be cut off at the same place in the spectrum.

During several years I have attempted to obtain the limit in the ultra-violet for stellar light here, but as it was necessary to make use of a bright star at a high altitude, and at a time when the atmosphere was very clear, it was not until September 20th, 1888, that I was able to obtain a result which seemed to me to be satisfactory.

On that night three successive photographs of Vega, with increasing exposures, were taken on the same plate. The first spectrum was exposed for 10 minutes, the second for 20 minutes, and the third spectrum nearly four times as long, namely, for 70 minutes.

A comparison of the extent of the second spectrum due to an exposure of 20 minutes with that of the third spectrum, to which an exposure of 70 minutes was given, leaves no doubt that the latter spectrum has reached the limit imposed by atmospheric absorption, and has not stopped in consequence of an insufficient exposure of the plate.

The original plate has been enlarged about four times; and a spectrum of magnesium and calcium, taken with the same apparatus, and enlarged simultaneously with the plate of stellar spectra, has been placed above to serve as a scale.

As the spectra are prismatic it is not possible to indicate the wave-lengths in a scale of equal parts. A short scale only is placed over the spectrum where the light of Vega ends.

The spectroscope with which the spectra were taken is furnished with a prism of Iceland spar and lenses of rock crystal, and a mirror of speculum metal was used to condense the light of Vega upon the slit.

It will be seen that at my observatory* the light of Vega at about λ 3000 is abruptly weakened, and then continues as a very faint line to the point of apparent extinction at λ 2970.

Numerous solar spectra taken here during the last four years with the same spectroscope show an average abrupt weakening at about λ 3000, and an apparent total extinction at about λ 2985.

On two occasions only the very faint weakened spectrum could be traced as far as λ 2970.

The abrupt narrowing of the spectrum at the end towards the red is produced by the rapid falling off of sensitiveness of the silver bromide for light of increasing wave-length.

The increase of breadth of the spectra with increase of duration of exposure is due to the same causes, optical and photographic, which produce the increase of diameter of stellar disks on the photographic plate with longer exposures, when a reflector is used. At *h* the breadths of the spectra, having 20 minutes and 70 minutes exposure respectively, are 0·06 inch and 0·105 inch.†

In 1879 Cornu‡ made experiments on the limit of the solar spectrum with reference to the altitude of the place of observation. On the Riffelberg, at an elevation of 8414 feet, the spectrum reached to λ 2932, while at the lower elevation of Viège, 2163 feet, the spectrum stopped at 2954. He concludes that the absorption is due to the gaseous constituents, and not to aqueous vapour in the atmosphere.

In 1881§ Hartley stated that an amount of ozone proportional to

* Elevation of the observatory 177 feet above mean sea level. Barometer about 30·03 inches at the time of observation.

† The law of increase of size of image with exposure is not as yet accurately defined. Bond found that the diameter of star-disks varied nearly as the square root of the time of exposure. Pritchard, using a reflector, found a law near the fourth root; and Mr. H. H. Turner has recently found a law very near the cube root for plates taken with a photoheliograph object-glass ('Astron. Soc. Month. Not.,' vol. 49, p. 292).

‡ "Sur l'Absorption Atmosphérique des Radiations Ultra-violettes," 'Journ. de Physique,' vol. 10, 1881.

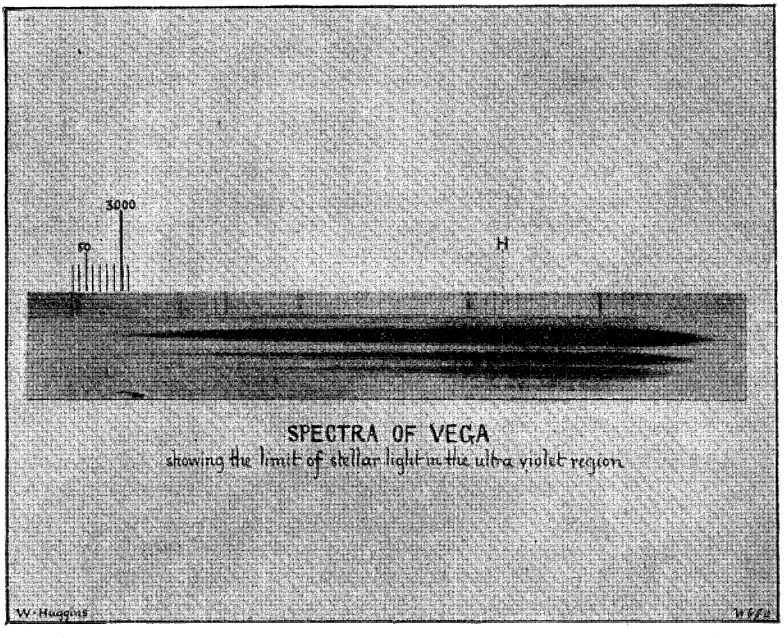
§ "On the Absorption Spectrum of Ozone, and on the Absorption of Solar Rays Atmospheric Ozene," 'Chem. Soc. Journ.,' vol. 39, 1881, pp. 57, 111—129.

the average quantity in a vertical column of the atmosphere, caused an absorption similar to that observed in the solar spectrum, namely, terminating about λ 2950.

Quite recently Liveing and Dewar have made some important experiments on the absorption-spectrum of large masses of oxygen under pressure.* They state that with a tube 165 cm. long and a pressure of 85 atmos., oxygen appeared to be quite transparent for violet and ultra-violet rays up to about λ 2745. From that point the light gradually diminished, and beyond λ 2664 appeared to be wholly absorbed.

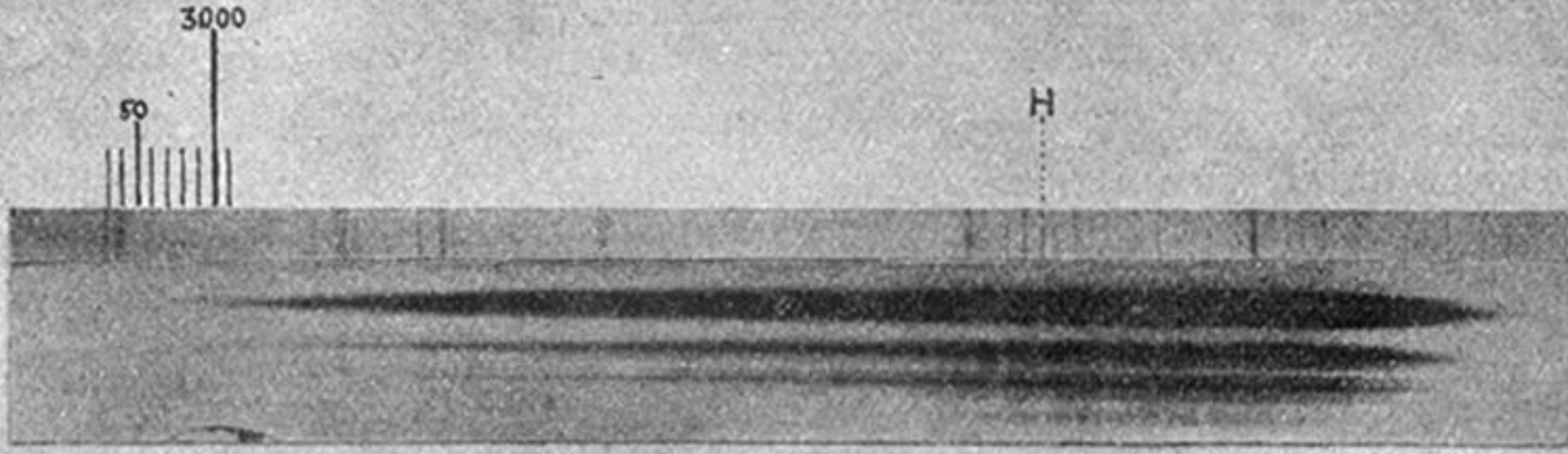
In some later experiments with a steel tube 18 metres long and a pressure of 90 atmos., oxygen produced complete absorption above P, *i.e.*, λ 3359·2.

M. Janssen, from his observations on the Alps, concludes that both the bands which follow the law of the square of the density, and the dark lines obeying a different law of formation, which are due to oxygen in the solar spectrum, are produced exclusively by the earth's atmosphere—"L'atmosphère solaire n'intervient pas dans le phénomène."†



* 'Chemical News,' vol. 58, p. 163, and 'Phil. Mag.,' September, 1888, pp. 286—290.

† 'Comptes Rendus,' vol. 107, p. 677.



SPECTRA OF VEGA

showing the limit of stellar light in the ultra violet region

W. Huggins

W&E